

MI8 line emittance monitor upgrade simulation

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MI8 line emittance monitor

❖ Current implementation

- ▶ Uses minimal set of profile monitors
 - No allowance for lattice function fluctuation.
- ▶ Calculation is done at scanner front end
 - Straight forward algebraic calculation.

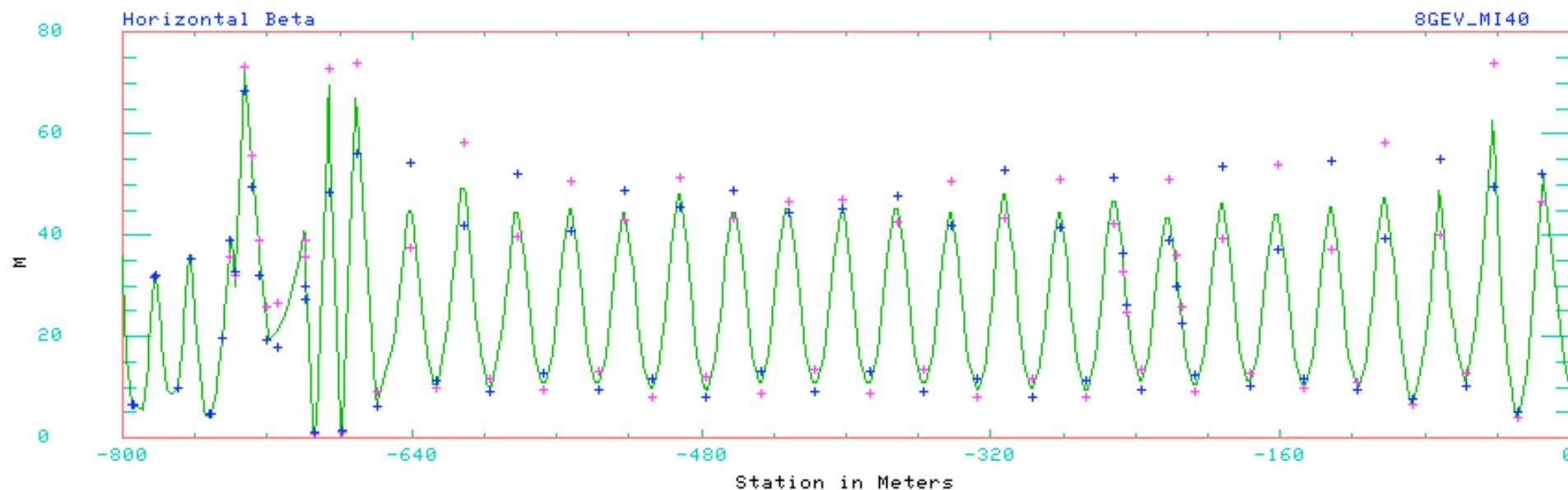
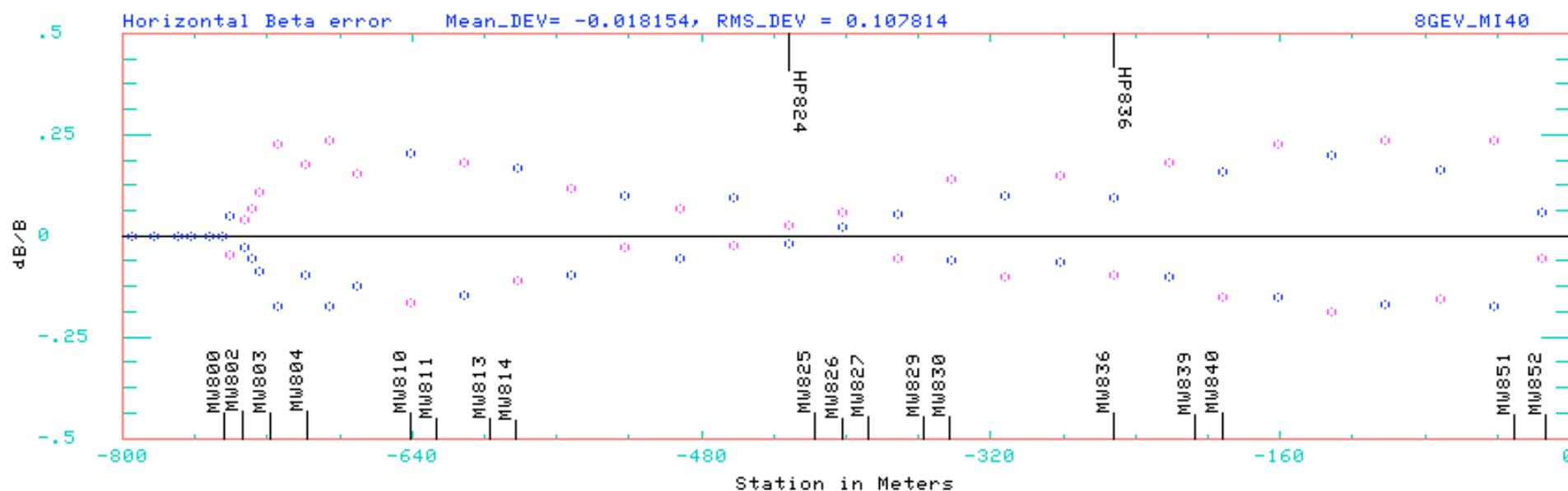
❖ Next version emittance monitor

- ▶ Able to detect lattice function change
 - Need new algorithm.
 - Need more CPU time
 - ✓ Front end is no longer a suitable host.
- ▶ More profile monitors
 - 5 in horizontal plane and 3 in vertical plane.
 - Need to pick additional locations.

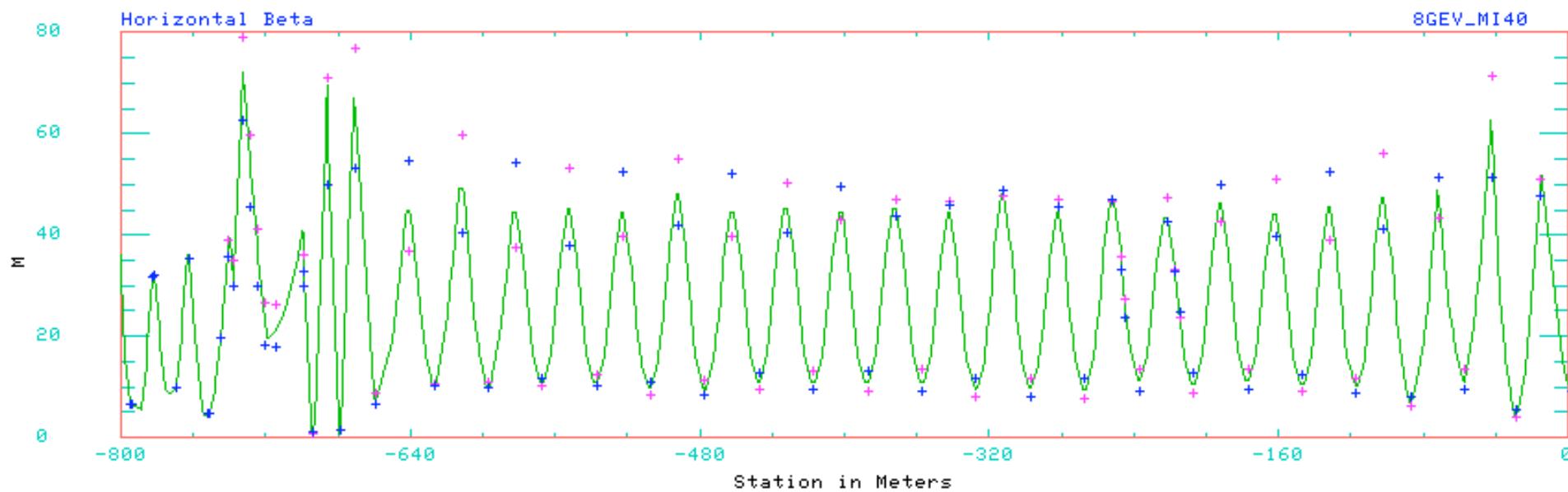
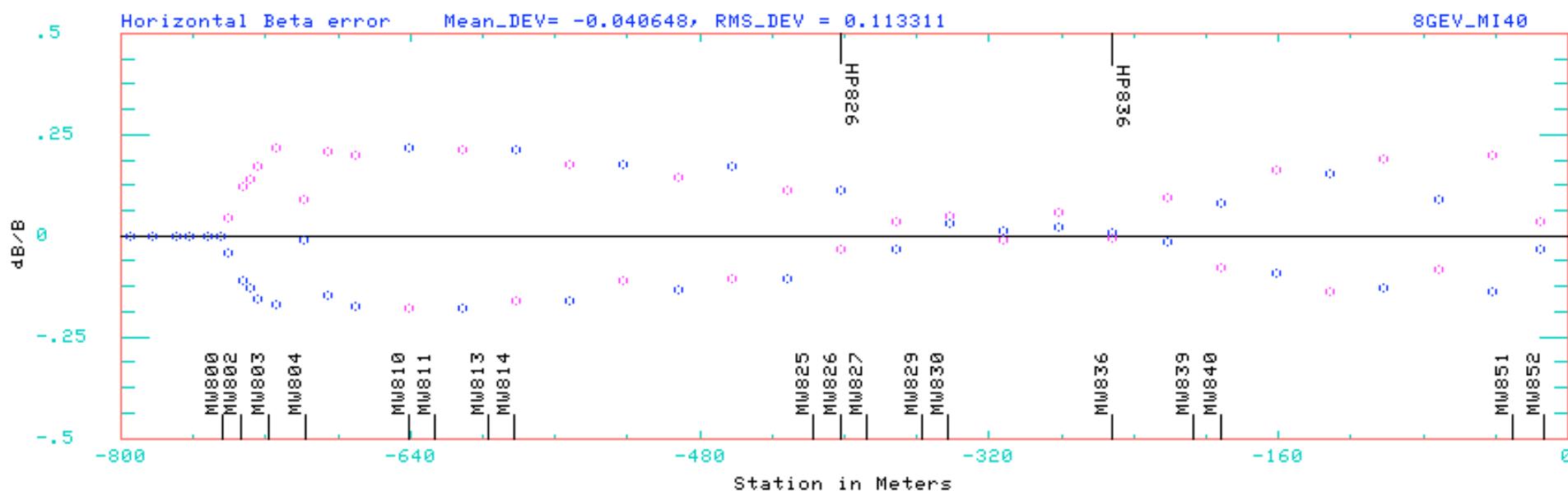
Simulation

- ❖ **Tracking lattice**
 - ▶ Visualize the effect of lattice function change.
 - Picking suitable locatons.
 - ✓ Within the permanent magnet region.
 - ✓ New monitors: mw810, mw814, mw830.
- ❖ **Ray tracing**
 - ▶ Generate beam profile data.
 - ▶ Change lattice function at mw800
 - Beta @ ± 4 meters from nominal.
 - Alpha @ ± 0.2 from nominal.
 - $\Delta p/p$ for 0.7 and 0.5 E-3.
- ❖ **Emulating emittance monitor**
 - ▶ Fit profile sigmas.
 - ▶ Initial lattice function search
 - I90 program
 - ✓ Sensitivity check.
 - Actual implementation

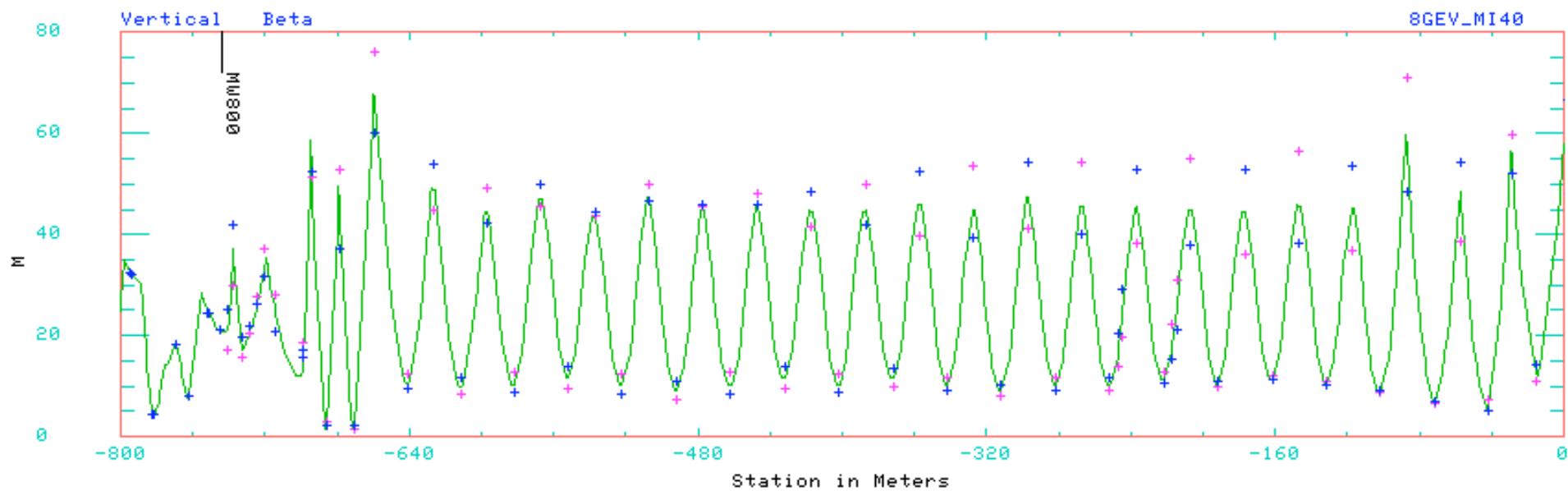
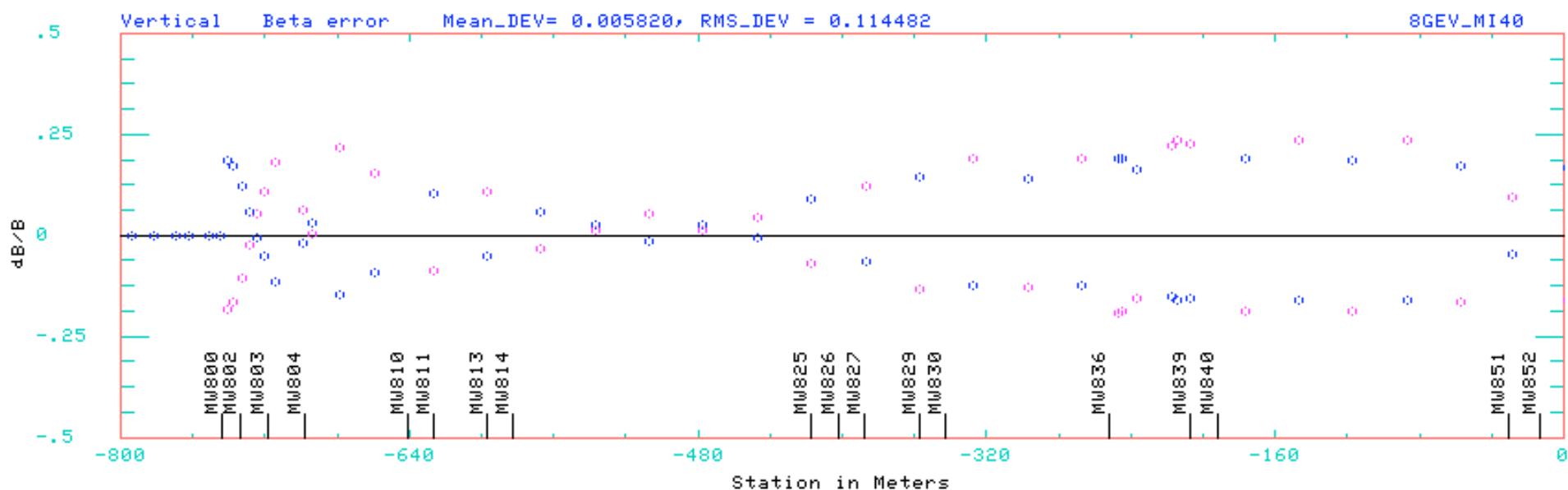
At mw800 horizontal, $\Delta\beta = \pm 2$ meter



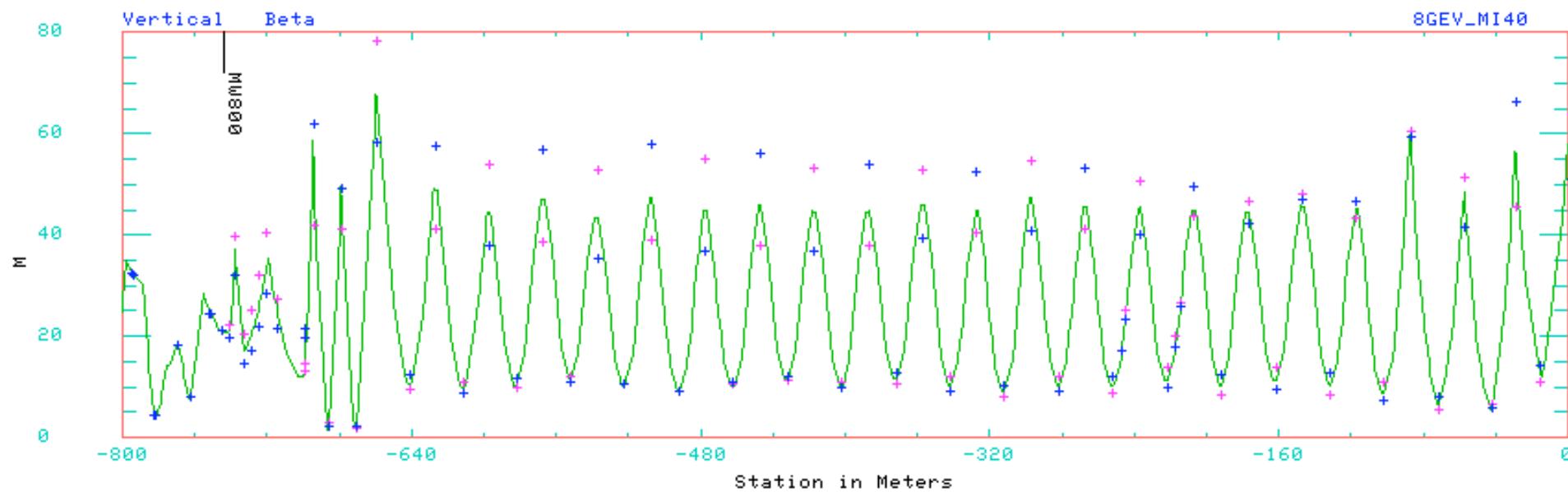
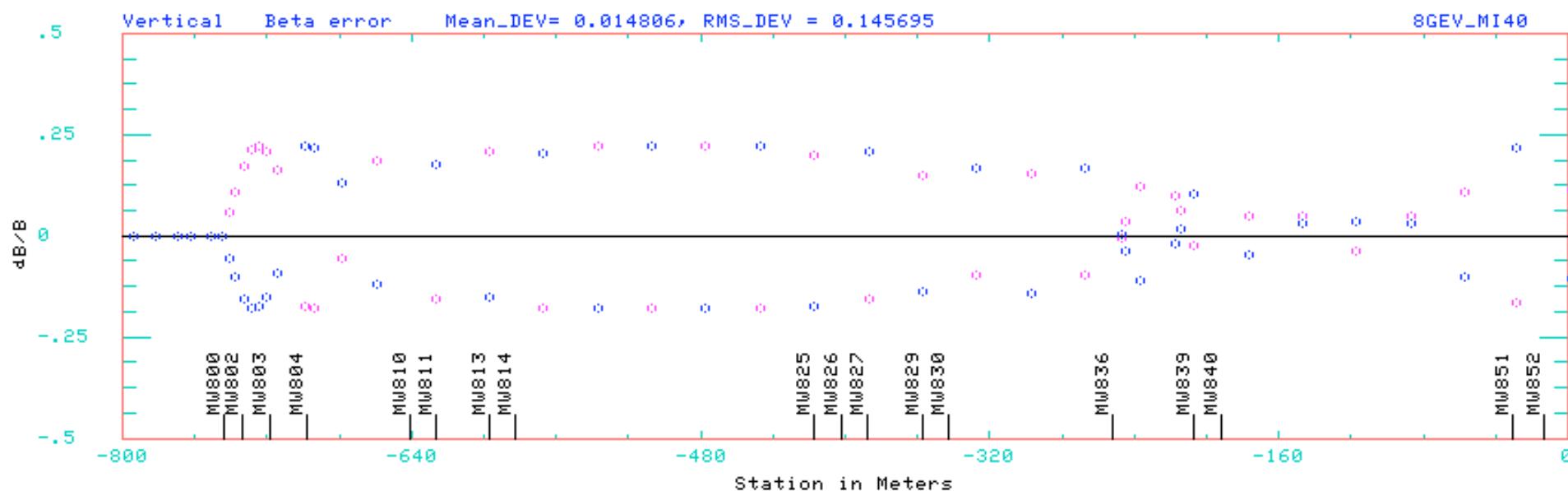
At mw800 horizontal, $\Delta\alpha = \pm .2$



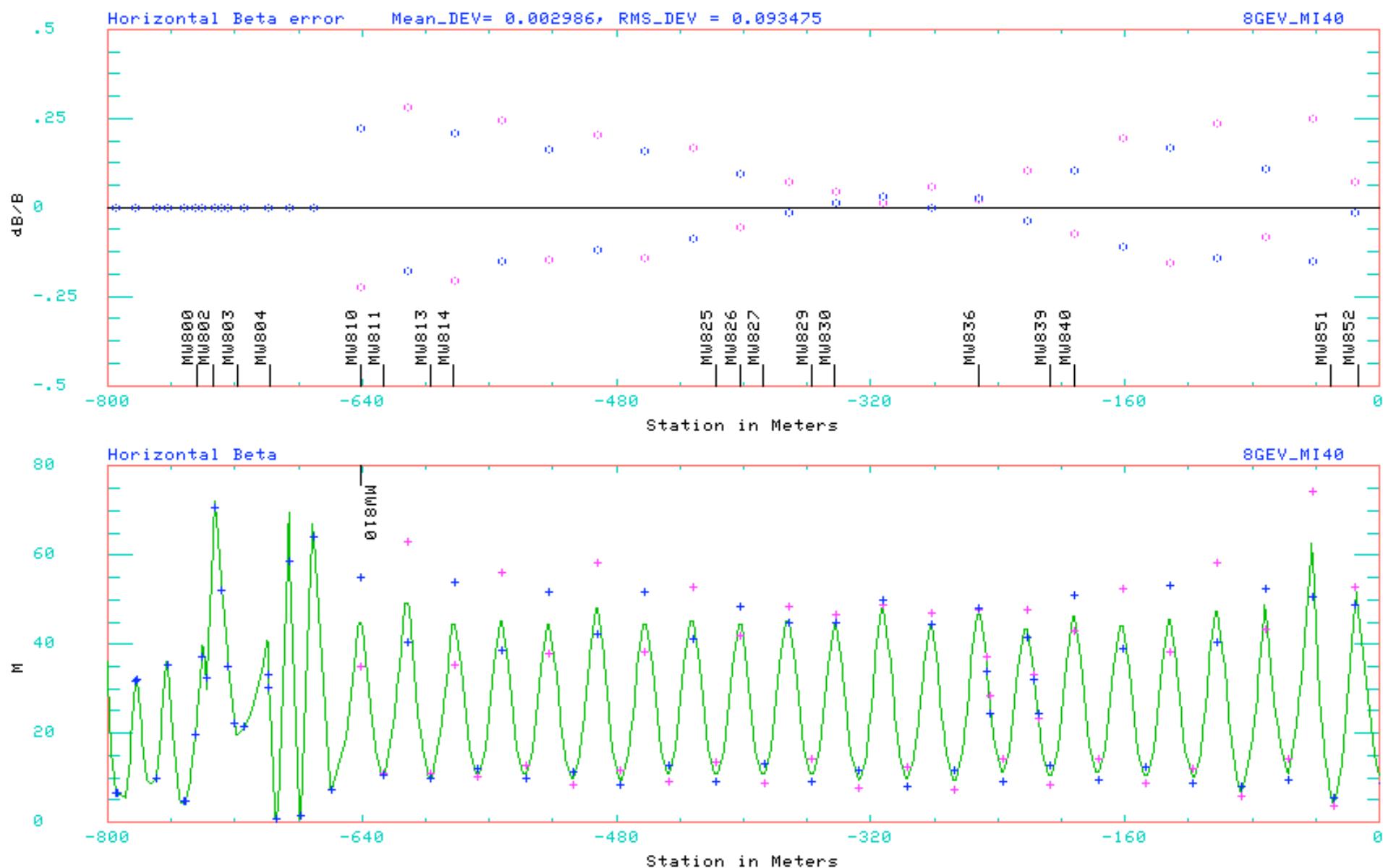
At mw800 vertical, $\Delta\beta = \pm 4$ meters



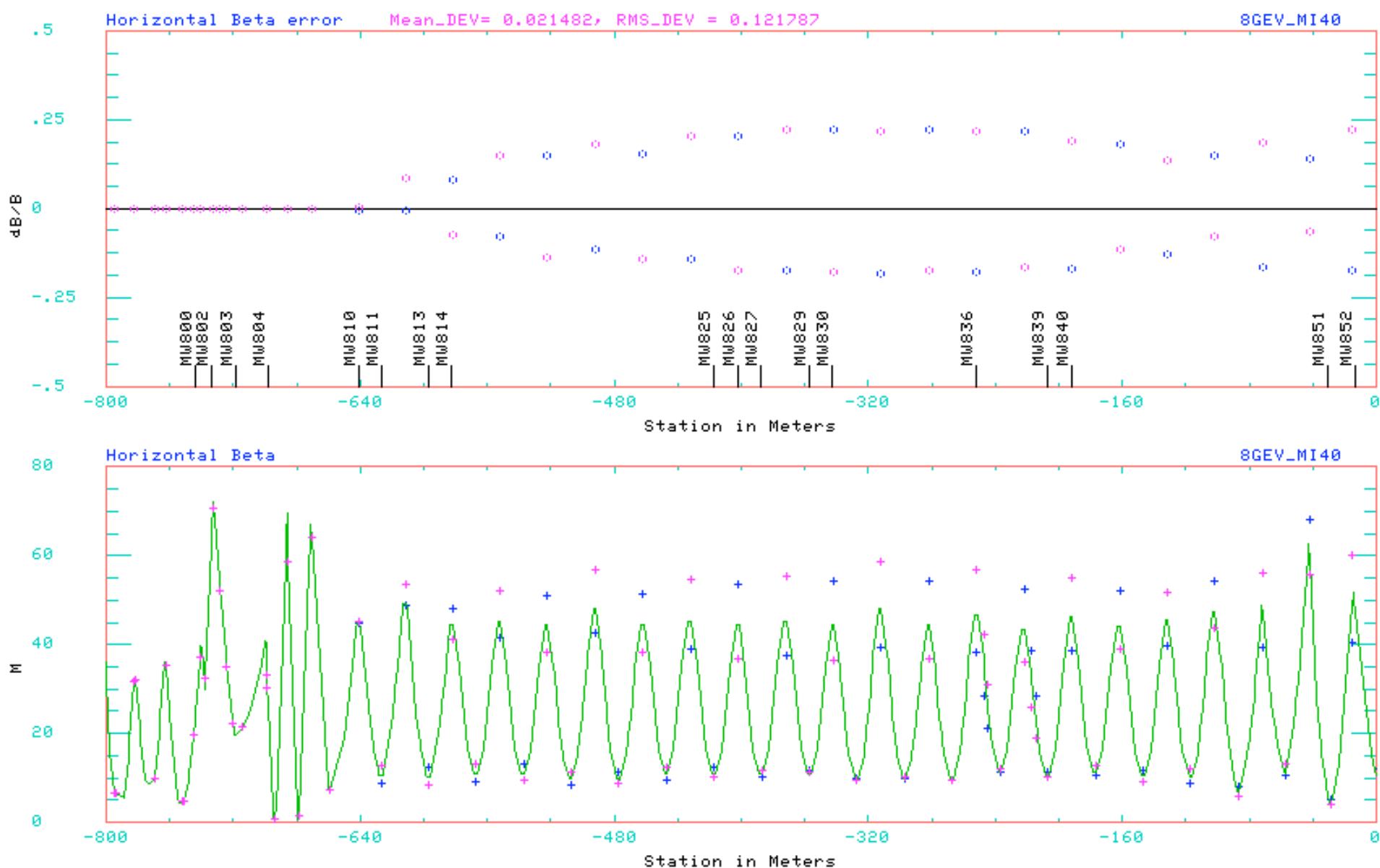
At mw800 vertical, $\Delta\alpha = \pm .2$



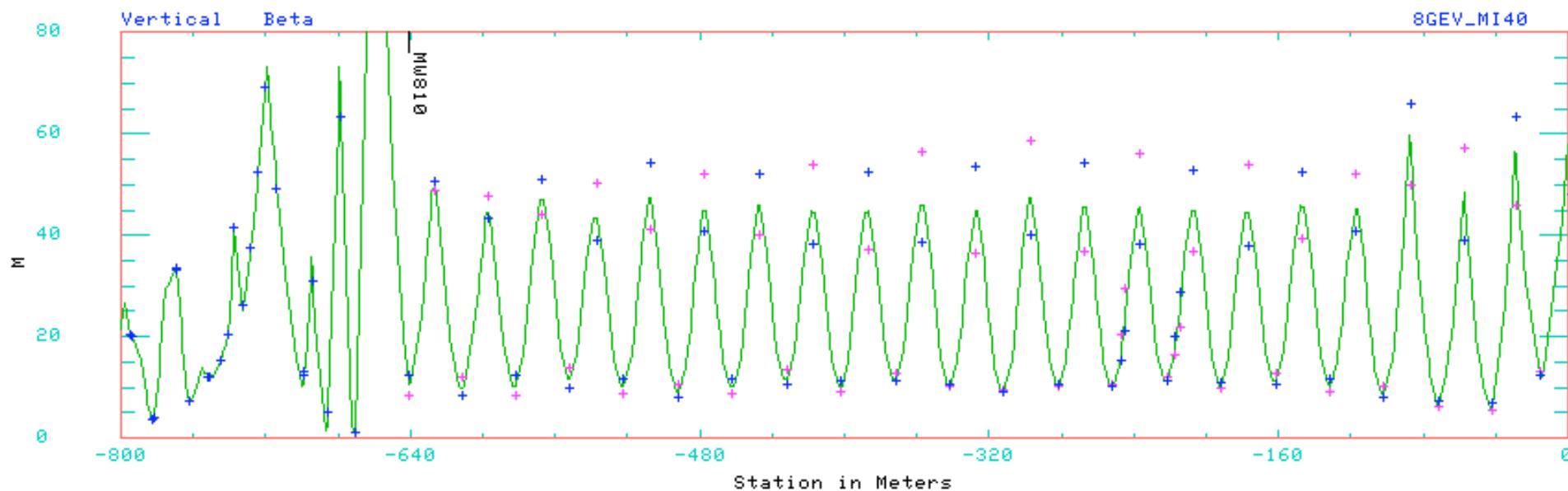
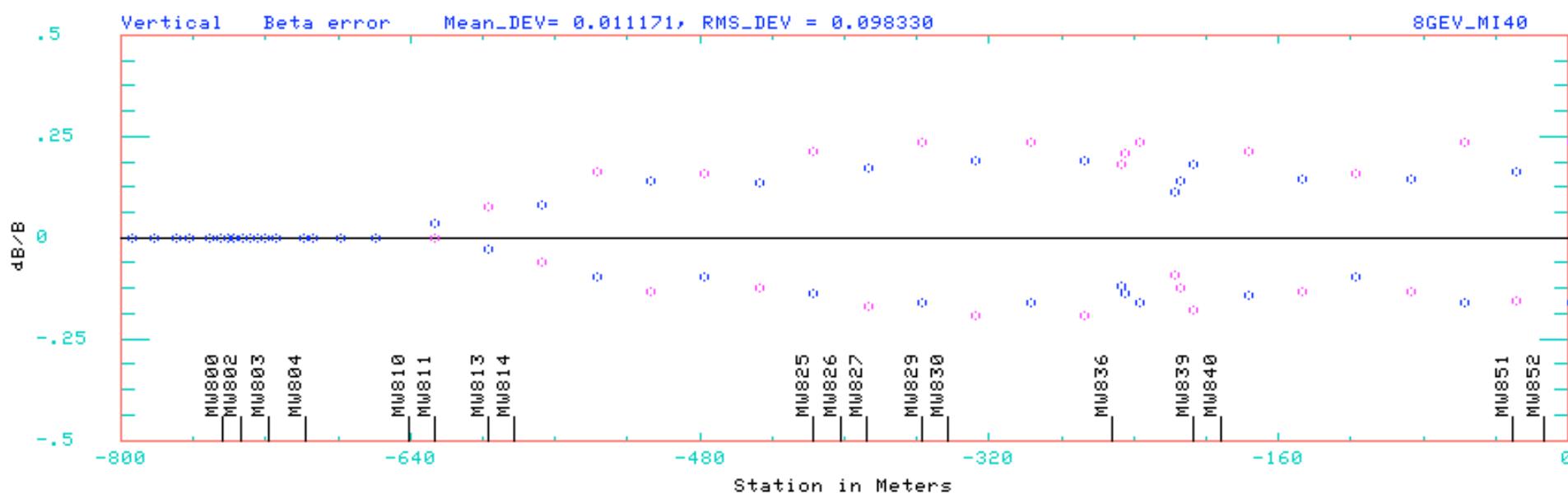
At mw810 horizontal, $\Delta\beta = \pm 4$ meters



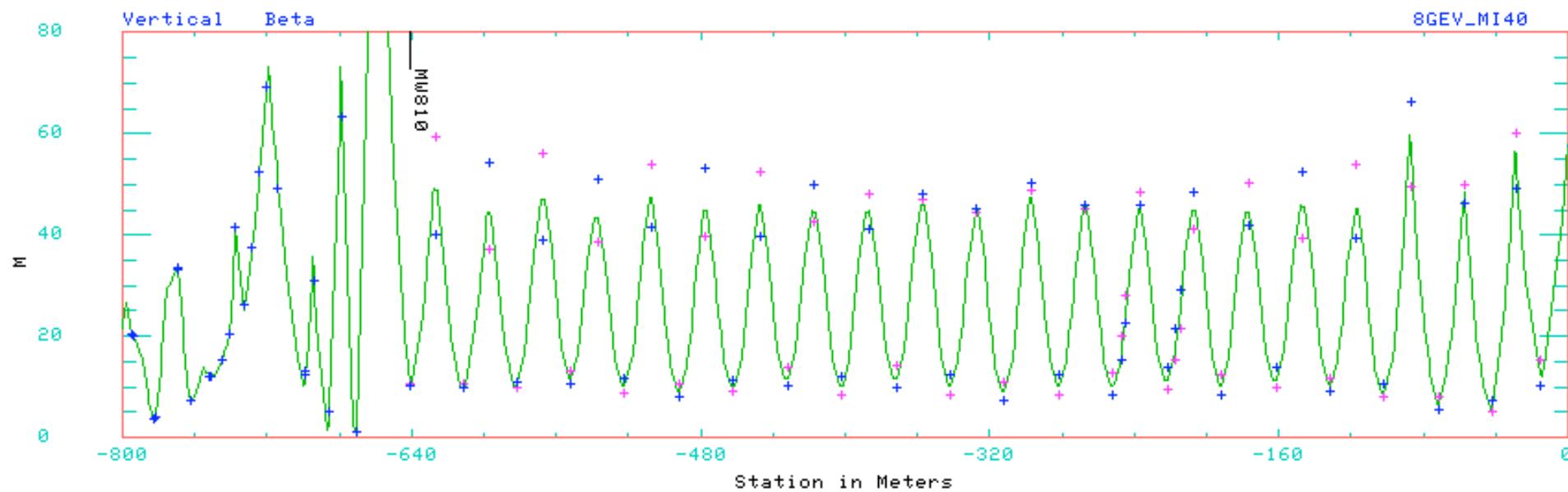
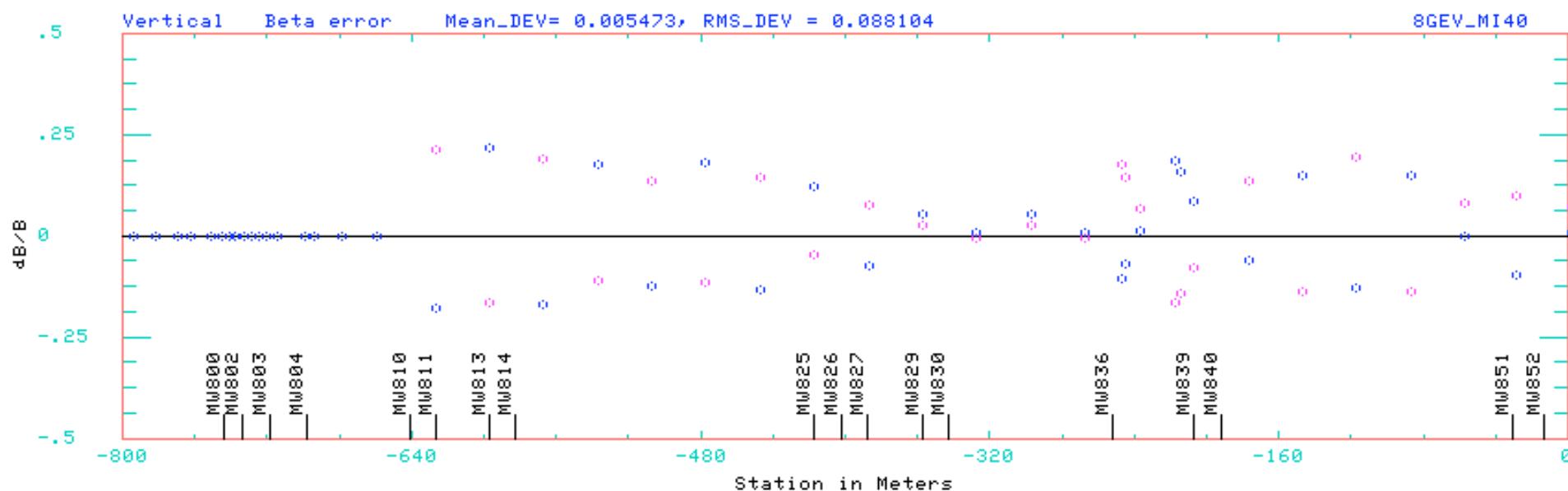
At mw810 horizontal, $\Delta\alpha = \pm .2$



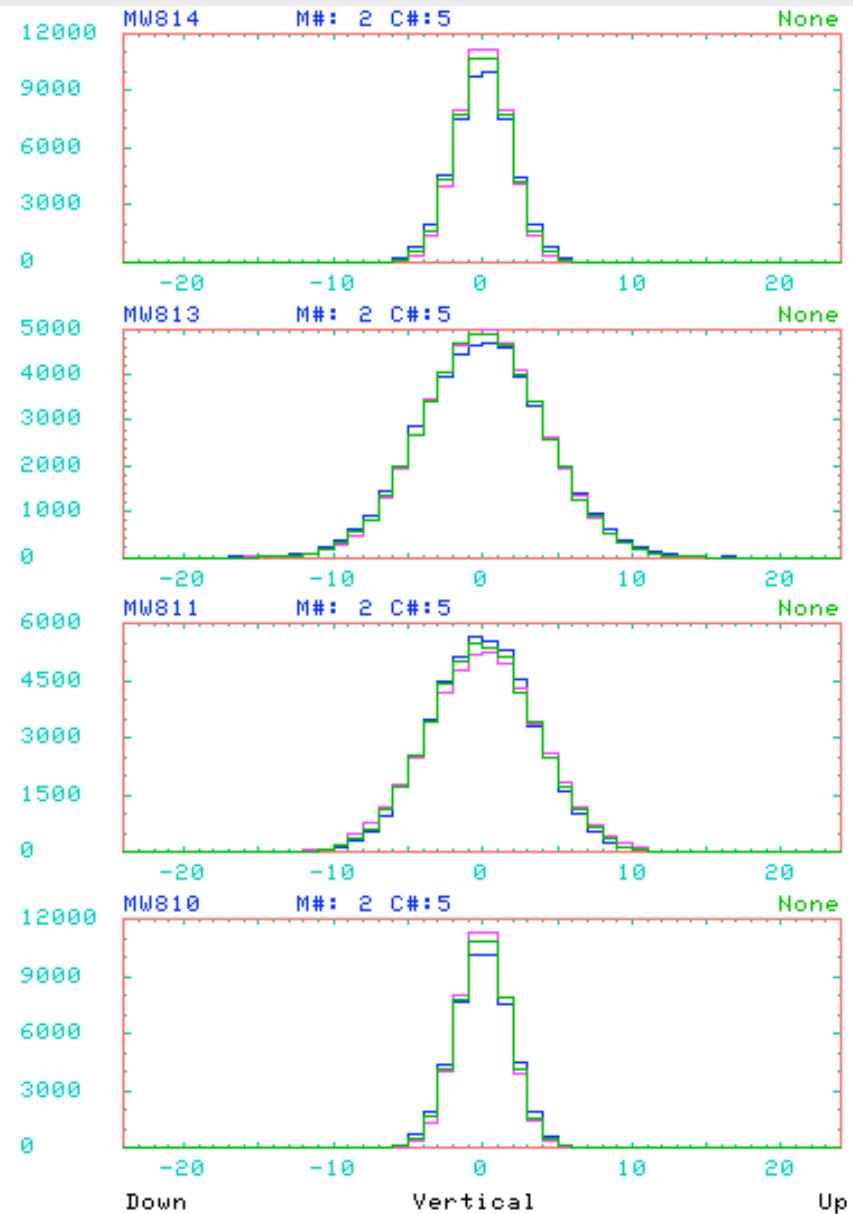
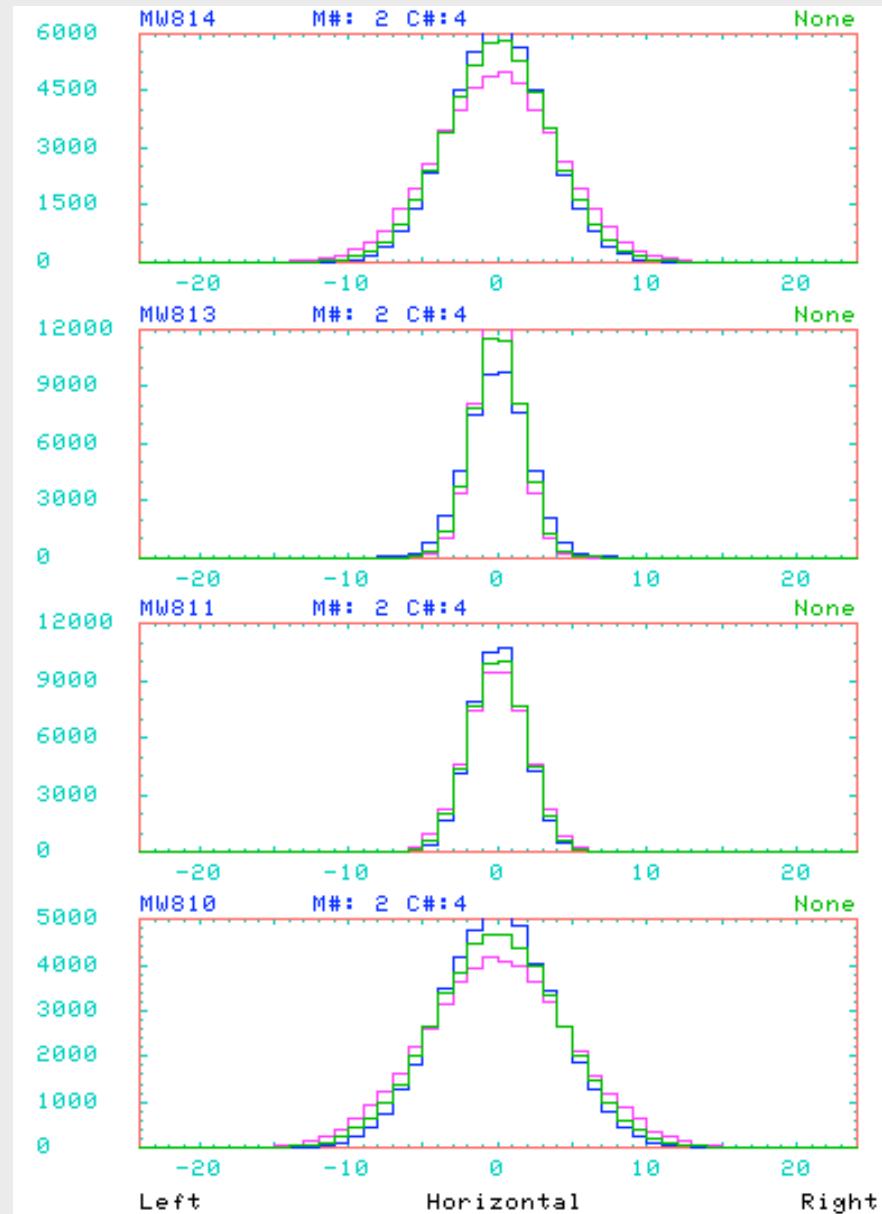
At mw810 vertical, $\Delta\beta = \pm 4$ meters



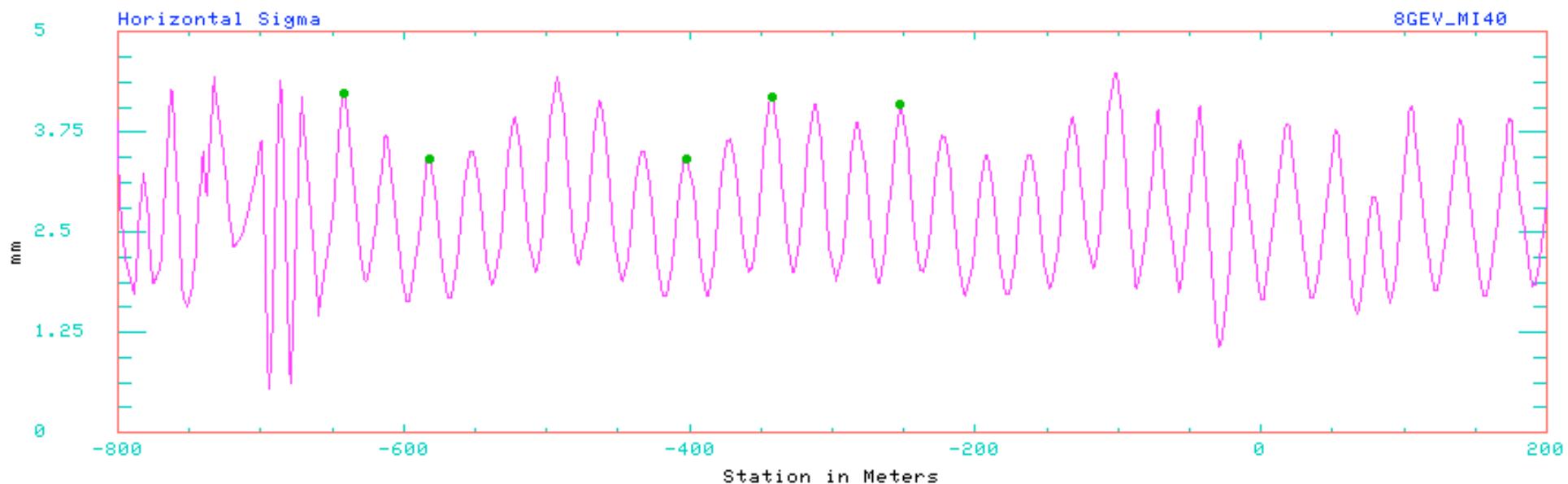
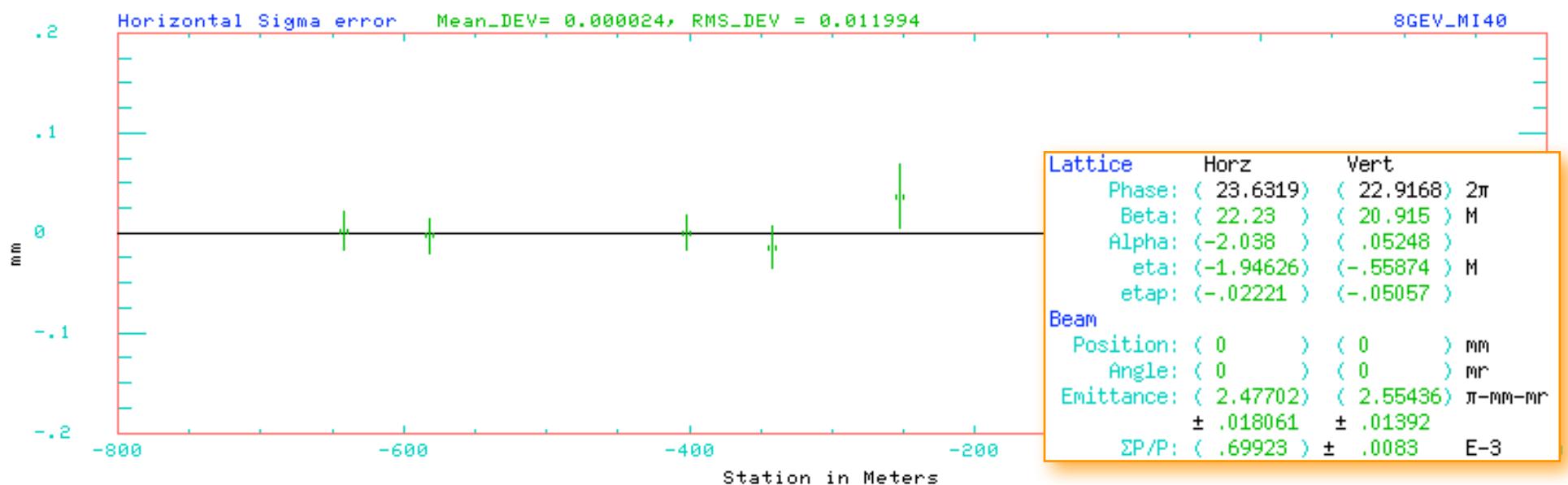
At mw810 vertical, $\Delta\alpha = \pm .2$



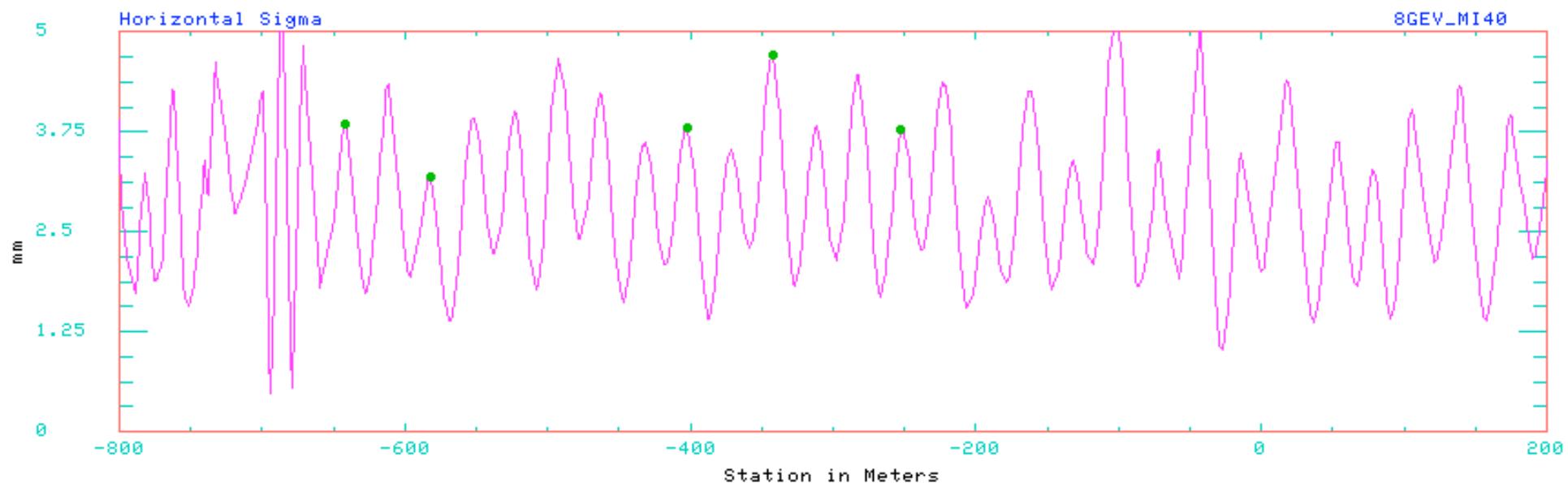
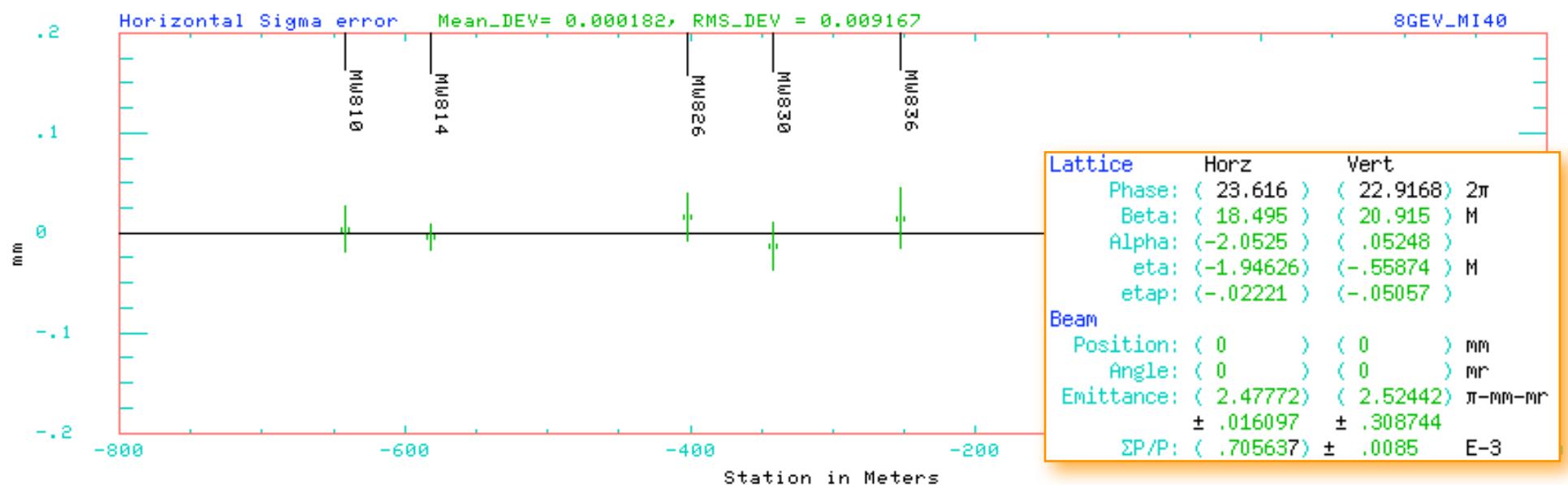
Profiles from simulation



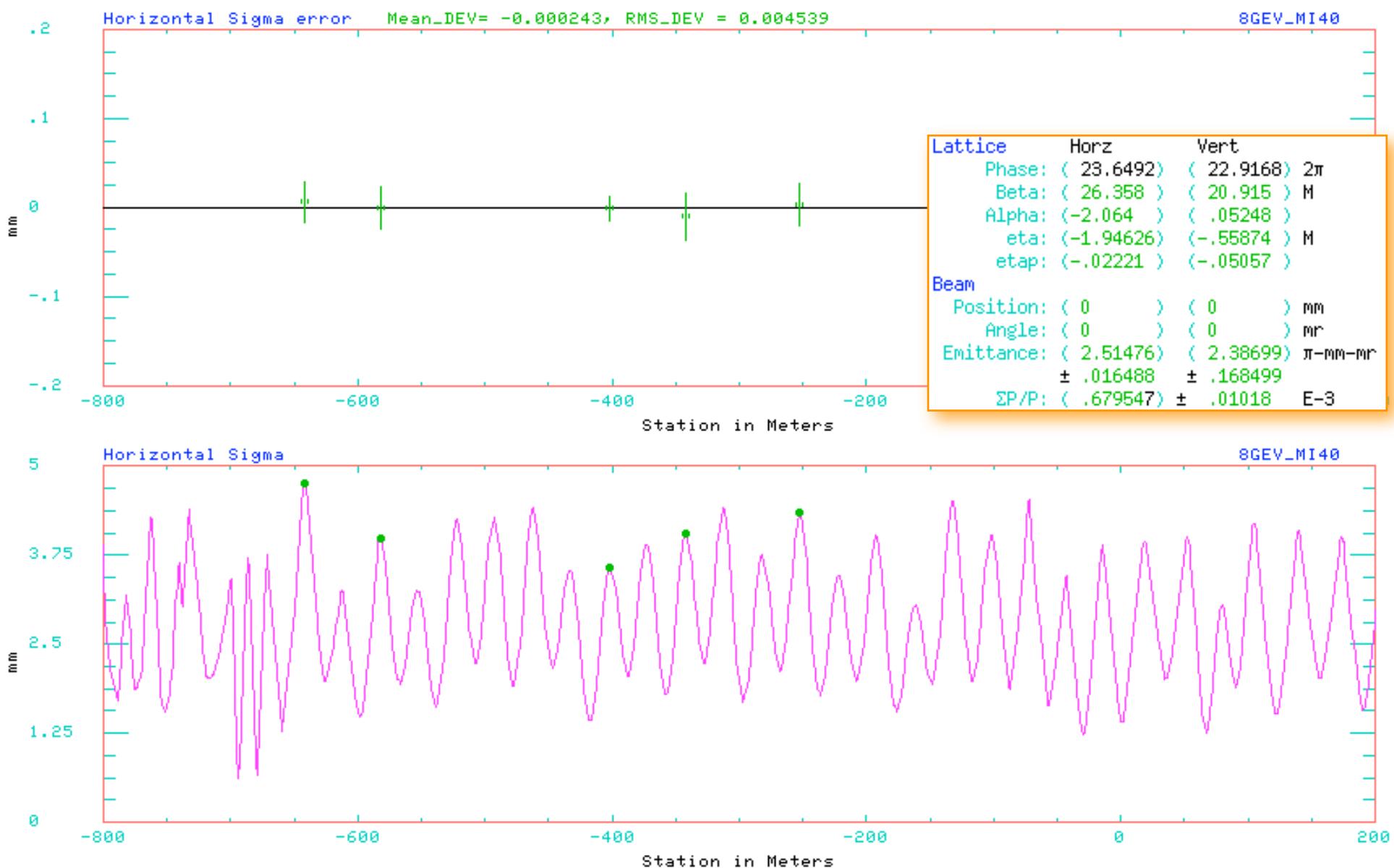
Sigma nominal horizontal



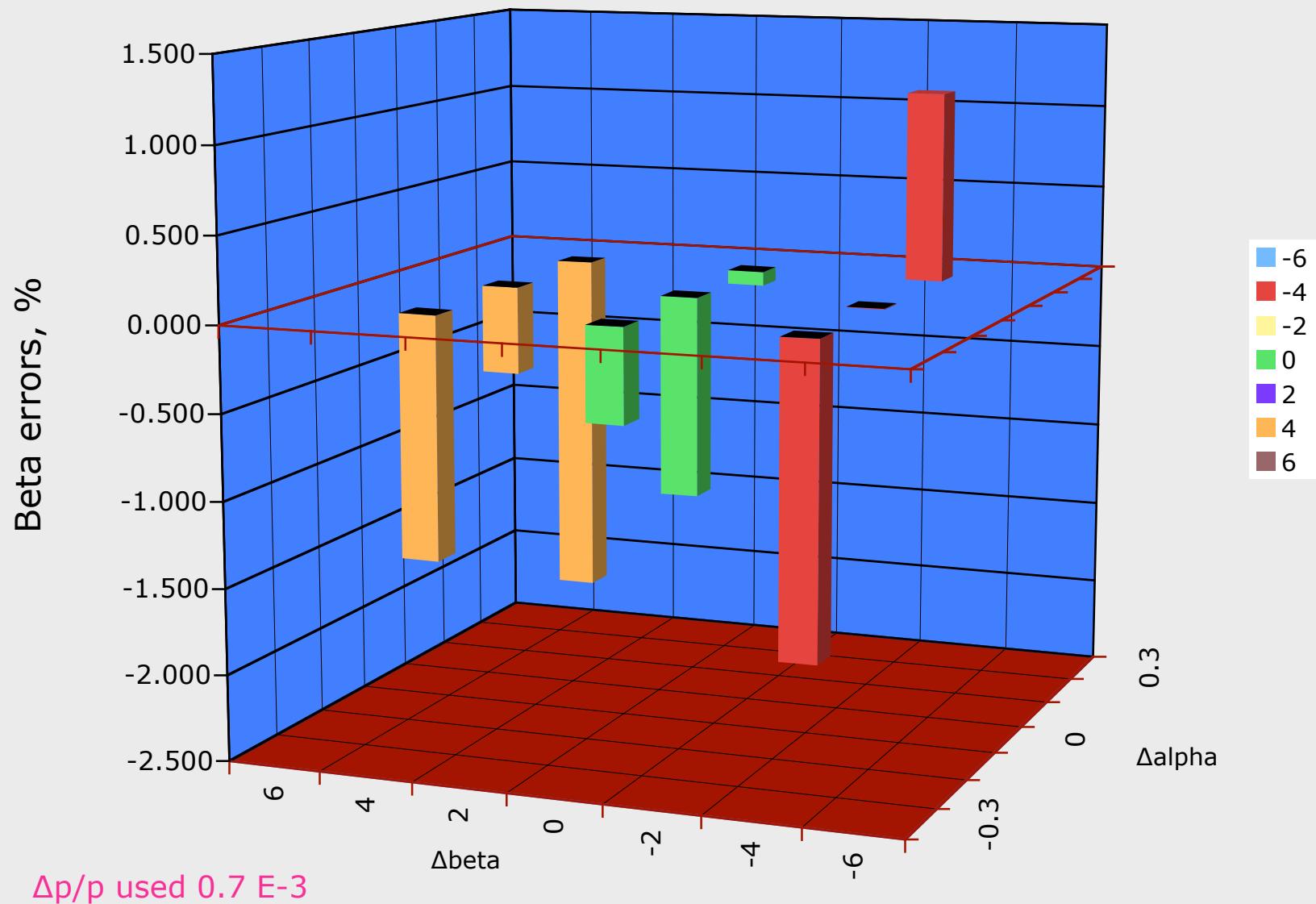
Sigma horizontal, $\Delta\beta = -4$ meters



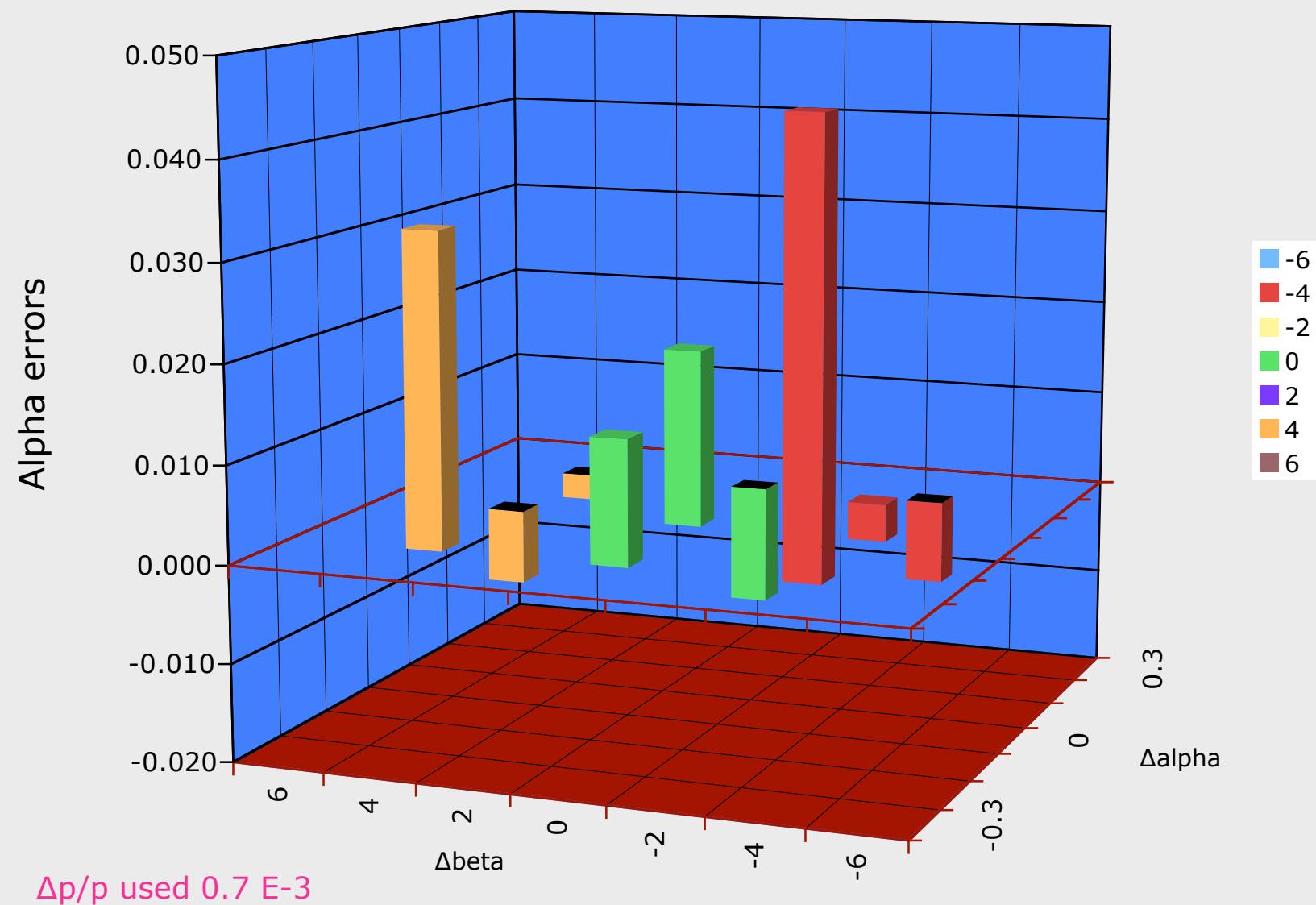
Sigma horizontal, $\Delta\beta = +4$ meters



beta error

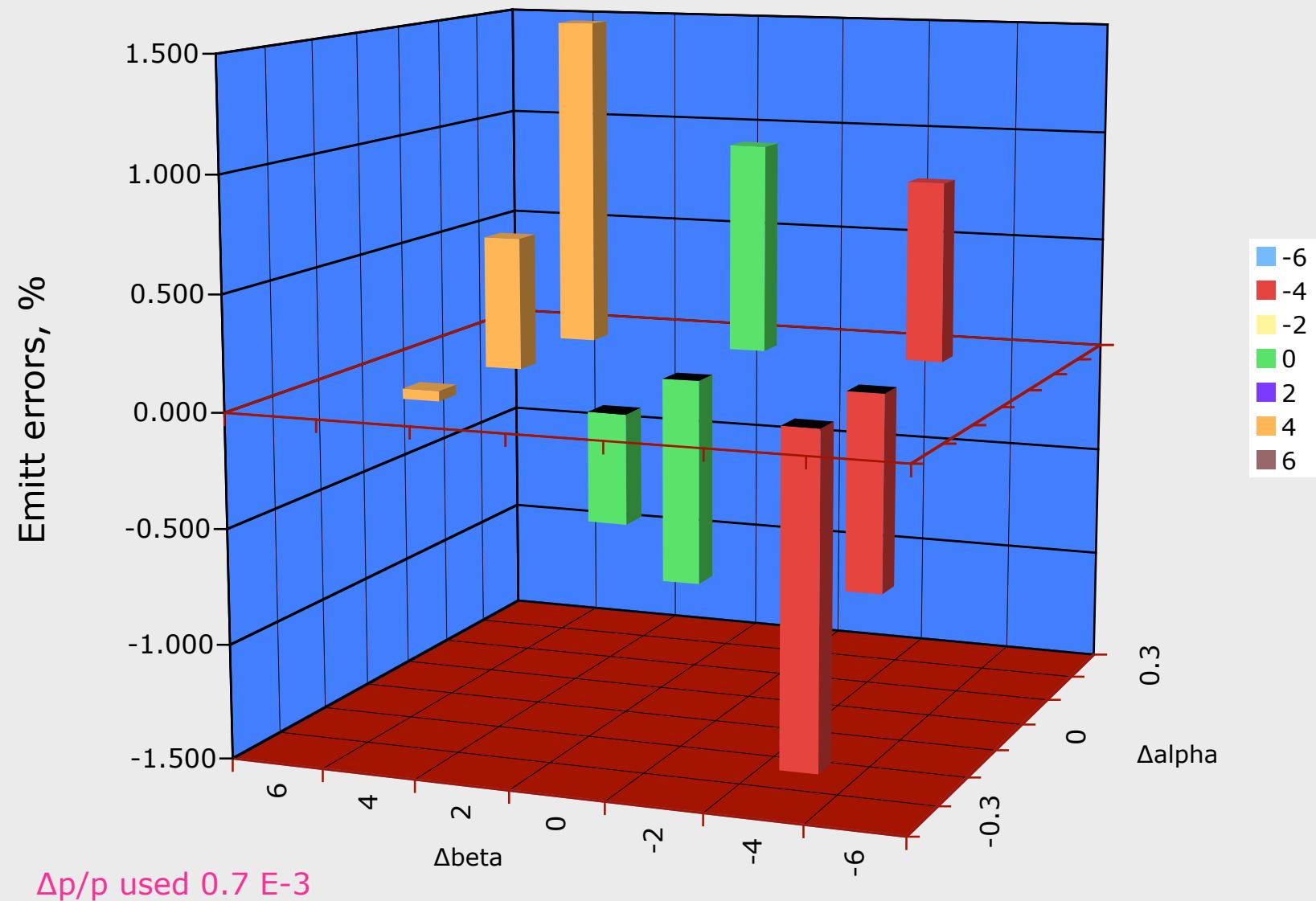


Alpha error

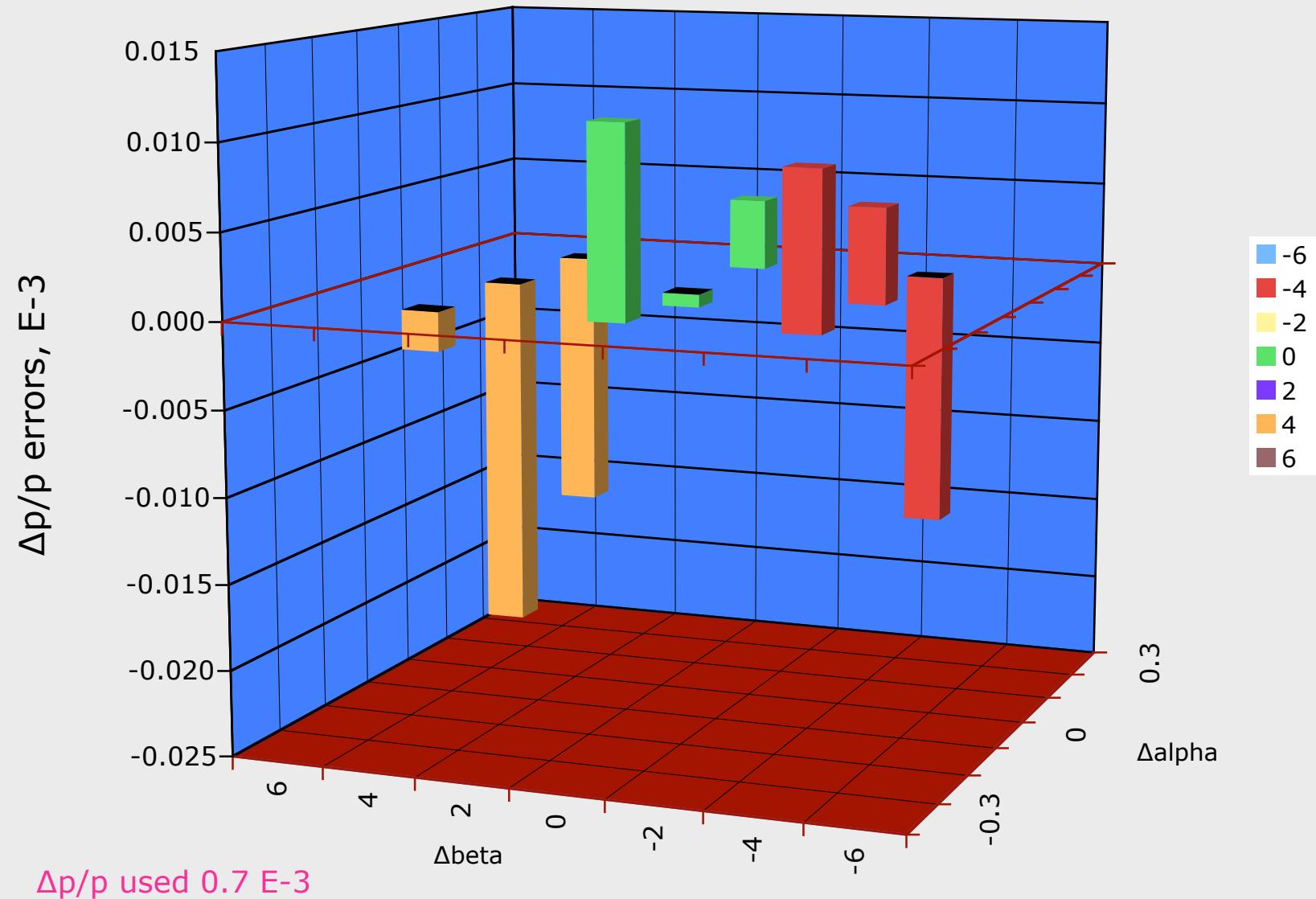


$\Delta p/p$ used 0.7×10^{-3}

Horizontal emittance error



$\Delta p/p$ error, @ $0.7E-3$



$\Delta p/p$ used $0.7 E-3$

$\Delta p/p$ error, @0.5E-3

